INTERFEROMETER SENSING AND CONTROL INSTALLATION

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ISC FUNCTIONS

❑ Initial alignment

- ○ Axial and transverse placement of optics
- ○ Optical levers for coarse alignment monitoring
- ○ Chamber video monitoring: illuminators and cameras

❑ Interferometer signal detection

- ○ Length sensors (heterodyne phase detection)
- ○ Wavefront sensors for alignment sensing
- ○ Annular photodetectors for mode matching (UF group)
- ○ Sensing system optical benches (tables)

❑ Controls electronics

- ○ Analog/digital closed loop length control system
- ○ Digital servo control system for alignment control
- ○ Supervisory controls for all front end electronics, photodetectors and beam steering on ISC tables

❑ Diagnostics

- ○ Excitation engine
- ○ Diagnostics test tools
- ○ Interferometer state monitors; triggers

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INITIAL ALIGNMENT

❑ Requirements

- ○ Angular positioning: ±0.1 mrad
- ○ Transverse positioning: ±1 mm to ±5 mm
- ○ Axial positioning: ±3 mm

❑ Procedure

- ○ Transverse and vertical positioning by sighting of fiducials with theodolite
- ○ Axial positioning by distance measurement feature of theodolite
- ○ Angular alignment by autocollimation

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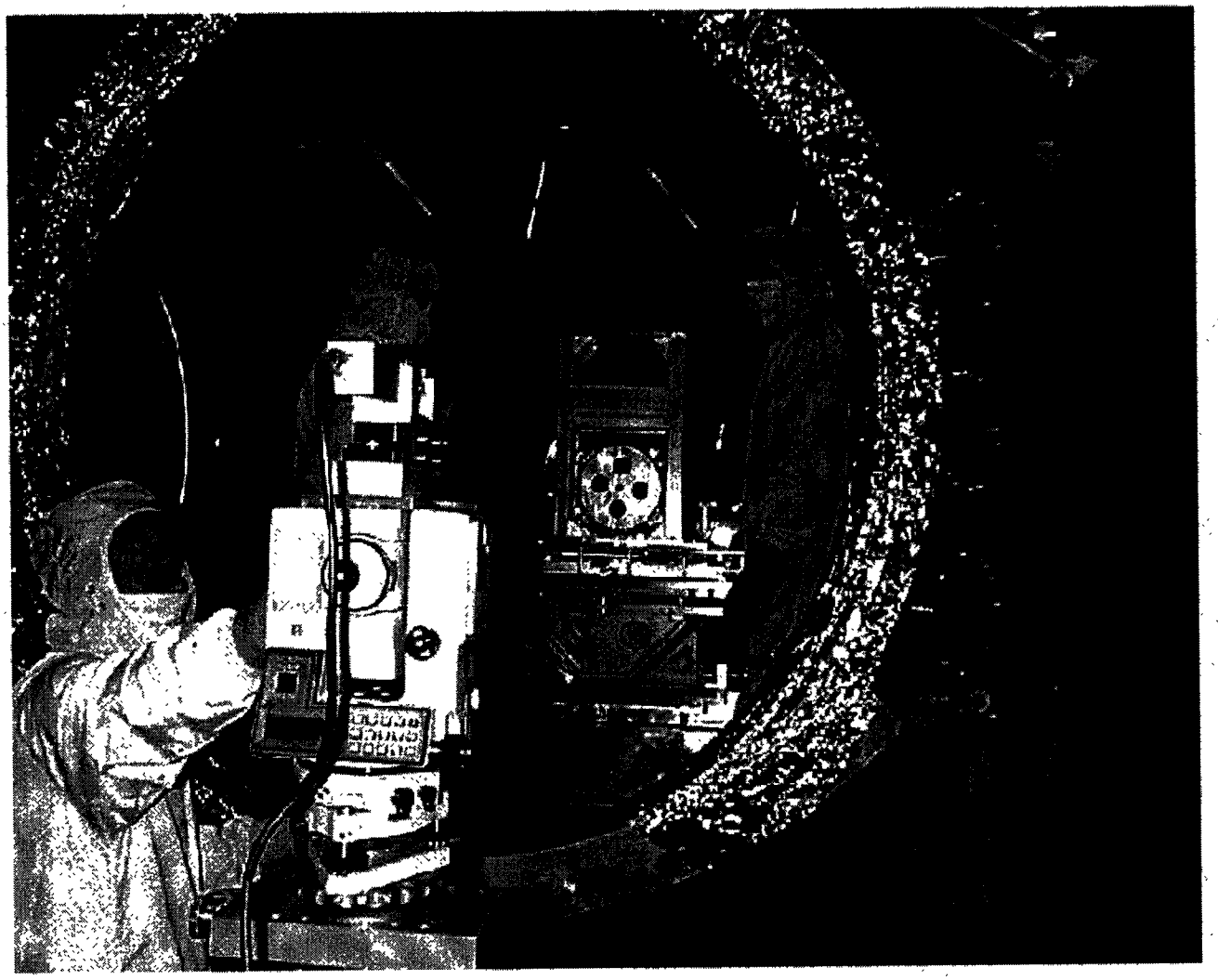
ALIGNERS IN BSC 9



ISC TABLE ASSEMBLY

- **Table contents**
  - Length sensing photodetectors (multiple PDs)
  - Quadrant wavefront sensors for alignment
  - Annular wavefront sensors for mode matching
  - Guoy phase telescopes for wavefront sensors
  - Light intensity monitoring PDs
  - Quadrant beam position monitor PDs
  - Mechanical and electrooptic shutters for PD protection
  - Trigger PDs for shutters
  - All beam steering optics and controls
  - Optical spectrum analyzers
  - Cameras
- **Tables assembled partly at MIT and in LHO staging area**

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IOT7 AT MIT

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IOT7 AT HANFORD

- IOT7 ready to pivot against HAM7 viewport

CONTROLS ELECTRONICS

❑ Front end

- ○ Photodetectors
- ○ Demodulators
- ○ Analog whitening/anti aliasing
- ○ A-to-D conversion
- ○ Digital filter computation
- ○ D-to-A conversion
- ○ Analog dewhitening
- ○ Control signals to suspension driver inputs

❑ Supervisory controls

- ○ Controls for all front end servo functions
- ○ Controls for all front end modules (PD gains, demod phases,...)
- ○ All beam steering and shutters on ISC tables

INSTALLATION AND TESTING

- **ISC electronics racks typically contain**
  - RF frequency synthesizers
  - Digital
    - CPUs, ADCs, DACs, GPS timing modules, binary I/O, reflective memory for data transfer
  - Analog
    - rf amplifiers, demodulators, analog filters, steering mirror drivers
  - Power supplies
  - Cross connects
- **Electronics racks installation**
  - Modules built/tested at MIT/CIT
  - Special test stands for module testing/diagnostics
  - Special tester cards for cabling and cross connects
- **Front/back end controls interface with data acquisition and diagnostics systems**
  - Some shared hardware and software

SYSTEMS TESTING

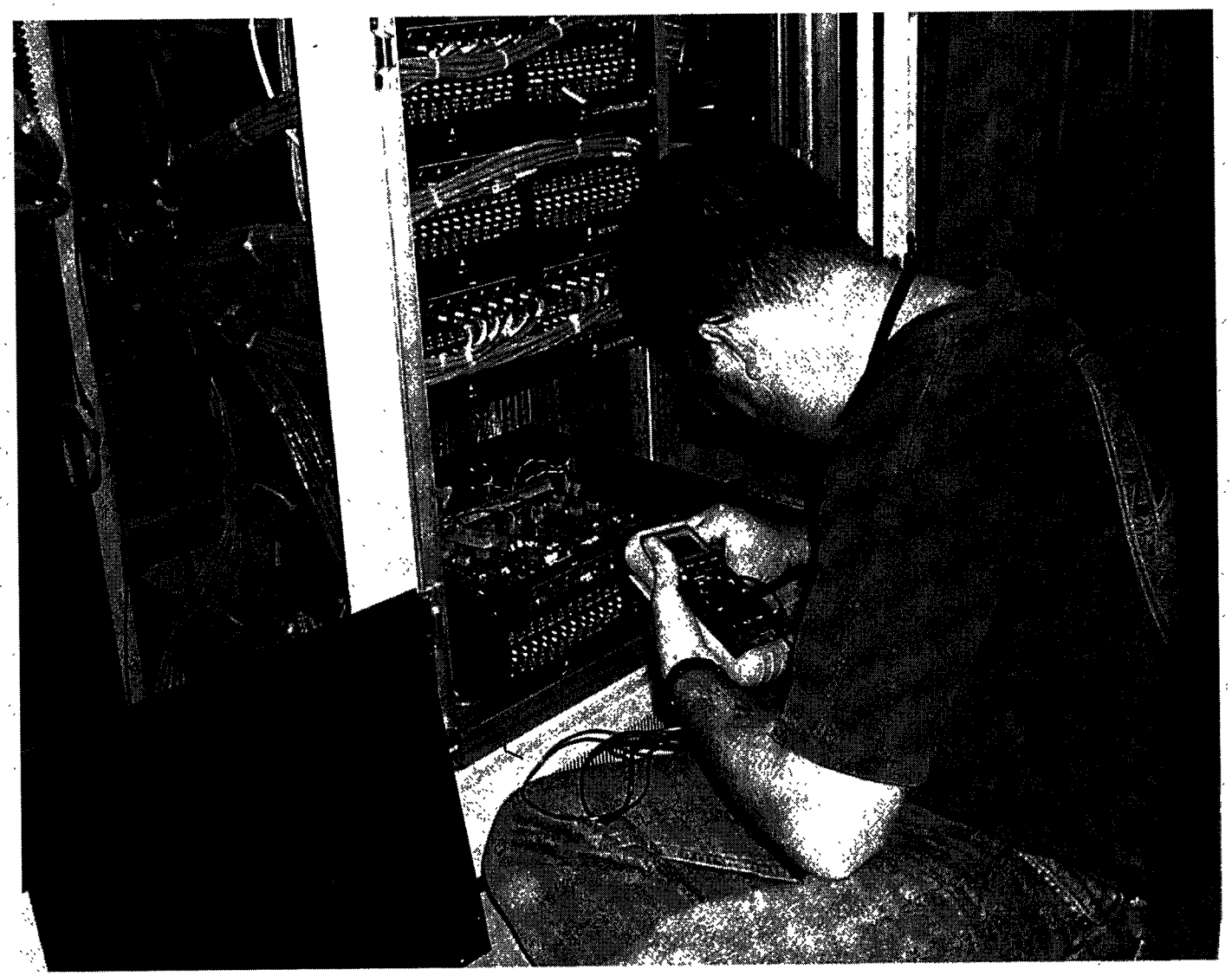
- ❑ **Table moved from staging area and aligned to vacuum view port**
- ❑ **Cabling from table to electronics racks**
- ❑ **Testing of full electronics path from PDs to DAC/DW outputs**
  - ○ AM laser simulates signal
  - ○ Multi-processor controls exercised open loop
- ❑ **Final tuning/calibration of all rf PDs**
- ❑ **Testing of shutter controls**
- ❑ **Testing of diagnostics excitation hw/sw**

INSTALLATION AND TESTING ACTIVITIES

- Gabriela characterizes suspension controllers

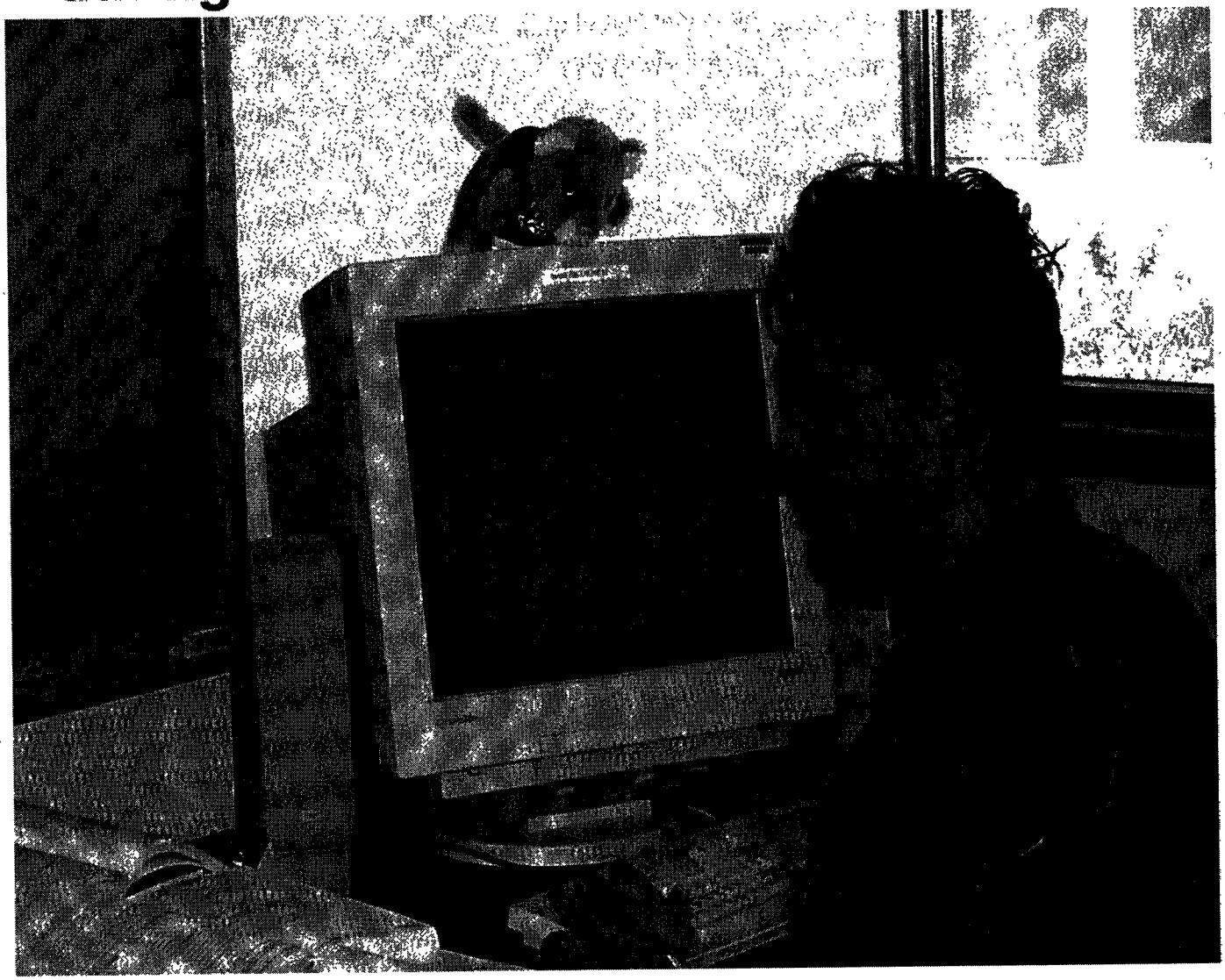
INSTALLATION AND TESTING ACTIVITIES

- Richard troubleshoots suspension controller



INSTALLATION AND TESTING ACTIVITIES

- Daniel writes and compiles and rewrites and compiles and ... diagnostics code during DAQ-GDS-ISC interface test



INSTALLATION AND TESTING ACTIVITIES

- Sany tests electro-optic modulators

INSTALLATION AND TESTING ACTIVITIES

❑ Nergis measures rf amplitude noise